**GEOLOGY** HAUNTED CANYON QUADRANGLE, ARIZONA Donald W. Peterson

INTRODUCTION quadrangle is in the northeastern corner of the Florence 30-minute of Gilbert (1875, p. 21-42) and in the Mountain region of Arizona as

defined by Ransome (1903, p. 10, 15-16). The quadrangle lies between the Superstition Mountains to the west and the Pinal Mountains to the southeast. The surface is in a mature stage of erosion and the

geologic mapping. Mr. and Mrs. solutions. V. H. Kennedy and Mr. and Mrs. William Lackey provided helpful

ROCK UNITS outcrops in the southwestern and and to a minor extent from on the map. rangle. Also of early Precambrian were spread over broad areas by areas near the southwest corner. glomerate northwest of Campaign the head of Haunted Canyon are rangle. extensively throughout the quad- bles of fine-grained quartzite and rangle. Paleozoic quartzites and jasper suggesting that a source of the dacite in some places, but age limestones, rather limited in areal metamorphic rocks was nearby. relations are uncertain. Finesouth-central, and east-central rangle near the West Fork of Pinto lithologically resemble both the Diabase of Mesozoic (?) age crops Scanlan consists only of a thin volcanic rocks, and their separation

area. Small- and medium-sized formation. porphyry crop out near the south- material of the Scanlan conglom- to Mesozoic or Tertiary. western corner of the quadrangle. erate, the pebbles and matrix of the Volcanic rocks of probable Ter- Barnes conglomerate were transrocks in places. The Gila conglom- to the northwest (Ransome, 1916, p. may overlie any of the older for- northeast to southeast (section northeastern part of the quad- composition and thickness over a Earlier volcanic rocks.-The tered about Case Knife Spring, near the eastern boundary. Several Arizona is remarkable. as successive flows and pyroclastic an eastward dip (section A-A', 11

tioned in the text because their stone. essential features are adequately PALEOZOIC ROCKS and others (1951, p. 10-24, 32-37, very poorly exposed. 39-46); and Peterson (1954). formations reported in table 1 incomplete exposures have incannot be traced for more than a in table 1 are very generalized.

which are considered reliable.

felsitic volcanic rocks. The rocks some of the Paleozic rocks of the the contact was placed at the base affected the older rocks. Locally strikes N. 15°-40° W. and dips about The Haunted Canyon quadrangle Geol. Survey Geol. Quad. Map Ransome, F. L., 1916, Some Pale- zona: Am. Jour. Sci., 5th ser., v. The Haunted Canyon 71/2-minute were metamorphosed at the end of quadrangle. The diabase of of the vitrophyre. early Precambrian time during the Haunted Canyon quadrangle and Although early workers con- have been mapped such as near the Inspiration quadrangle for several belt of mineralization, as in only a Peterson, N. P., Gilbert, C. M., and their correlation: U. S. Geol. Sur- Stoyanow, A. A., 1936, A correlation Mazatzal revolution of Wilson adjacent region may represent sidered the dacite to be a lava flow, mouth of the West Fork of Pinto miles to the southeast and south few places are weakly mineralized Quick, G. L., 1951, Geology and ore vey Prof. Paper 98-K. of Arizona Paleozoic formations: (1939), and it is likely that quartz intrusions of more than one age. In properties of the dacite body more Creek. Similar complex patterns and Range physiographic province diorite and Ruin granite were his early work in the Globe and Ray nearly correspond to those charprobably are rather widespread in structures of the Castle Dome area After the intrusion of diabase and Gila County, Arizona: U. S. Geol. deposits of Ray and Miami, Ariemplaced during this revolution. quadrangles, Ransome assigned the acteristic of bodies of welded tuff. the Cenozoic rocks, but they were Ruin granite probably intrudes diabase to the Paleozoic or Meso- Fluid lavas as silicic as dacite are not recognized because of a lack of Pinal schist, but contacts between zoic (Ransome, 1903, p. 86; 1919, p. highly viscous, but this dacite consistent marker horizons. In the two formations are not exposed 56). Darton and Short and others body shows neither the dimensions most areas the available evidence in this quadrangle. Quartz diorite favored a pre-Devonian age for the nor the swirling flow structures does not clearly indicate whether intrudes the schist and seems to be large masses of diabase (Darton, characteristic of viscous lavas. The the attitude of these rocks is due to unconformity below the Gila con- but some of it collected in low-lying ore deposits of the Bisbee quad- zona Bur. Mines Bull. 151.

Mazatzal revolution in central overlain by Scanlan conglomerate, 1925, p. 254; Short and others, 1943, wide lateral distribution and gen-initial dip, local tilting, or both. but good exposures for study of p. 38). East of the Castle Dome erally consistent planar structures Faulting ranges in age from ridges and peaks are separated by the contact with the conglomerate mine, however, Peterson and co- of the dacite are characteristic of older than the diabase to younger canyons with moderately to steeply are few. However, the conglom- workers found evidence that at pyroclastic deposits. Relict pyro- than the Gila conglomerate. Most

sloping sidewalls. Altitudes range erate contains lenses and pockets least some of the diabase is post-clastic structures and textures, faults cannot be accurately dated; it from 2,910 feet in the valley of of coarse granules of quartz and Pennsylvanian (Peterson and abundant broken phenocrysts, and is likely that many of them were ac-Pinto Creek to 5,991 feet at the feldspar that could well have been others, 1951, p. 35-36). In the censummit of Pinto Peak. Local relief derived from the quartz diorite. tral and south-central parts of the also suggest that the dacite is a formation. The earliest faults ranges from 300 to 1,200 feet. A thin chilled border of quartz quadrangle, basal conglomerates of product of an explosive eruption. preceded or accompanied the in-All the streams in the quadrangle diorite lies along schist contacts, Troy quartzite and Martin lime- The dacite was probably emplaced trusion of the diabase and many of are intermittent. Most of the but no such border was recognized stone overlie diabase, but whether by eruptions of the "glowing avaquadrangle is drained eastward below the Scanlan conglomerate. the contacts are intrusive or depointo Pinto Creek, which flows These facts suggest that the con- sitional could not be determined. remained viscous after coming to is intricate in areas of much dianorthward to the Salt River. A tact is sedimentary rather than Less than half a mile south and rest. The basal and central parts base; the apparent direct relation small area in the northwest corner intrusive. The quartz diorite is southwest of the Kennedy Ranch, of the mass were firmly compressed between the complexity of faulting is drained by Pine Creek, also a lithologically similar to the Madera the mapped relations suggest that by the combined action of the and the amount of diabase suggests tributary of the Salt River. An diorite of the Pinal Mountains diabase intruded Martin limestone weight of overlying material and that intrusion of the diabase was an the Haunted Canyon quadrangle volcanic eruptions. area in the southwest corner (Ransome, 1903, p. 58-67), but as the and Escabrosa limestone. The heat. During the cooling, gases important cause of deformation. drains by way of Wood Camp nearest exposures of Madera diorite relations on the ground are not were released and intimately per-Canyon into Queen Creek, a trib
are some 12 miles to the southeast, clear, however, because massive meated the upper parts of the mass.

after diabase emplacement, and at volcanic rocks. The rocks were amount of the upper part of the utary of the Gila River to the utary of the Gila River to the layers of Escabrosa limestone have a correlation would be questionable. layers of Escabrosa limestone have least some of the deformation in-Within the quartz diorite just south slumped downward over both dia- actions caused various amounts of volving Cenozoic rocks took place The quadrangle is reached by a of the point where Rock Creek base and Martin limestone, and alteration, devitrification, and crys- along preexisting faults. The exgraded dirt road that leaves the crosses the western quadrangle heavy vegetation obscures the containing the crosses the western quadrangle heavy vegetation obscures the containing the crosses the western quadrangle heavy vegetation obscures the containing the crosses the western quadrangle heavy vegetation obscures the containing the crosses are contained by th Castle Dome mine road 2 miles boundary are several irregular tacts between formations. The the pyroclastic texture of the of the head of Haunted Canyon and north of U. S. Highway 60-70. The bodies of a rock composed almost diabase is tentatively assigned to groundmass. south of the Kennedy Ranch are mine road meets the highway 4 miles west of Miemi miles west of Mi lized quartz. The composition of and others (1951, p. 35). Nels P. Peterson supervised the the rock indicates that it has been Diorite porphyry.—Diorite porwork and performed part of the thoroughly altered by hydrothermal phyry was intruded partly as dis-

continuous sills and partly along streams in low-lying areas on the CAMPAIGN CREEK BLOCK faults as irregular bodies of various surface that was produced by the Ruin granite crops out over most of overlying rock must have been lift accompanied by faulting, and UPPER PRECAMBRIAN ROCKS shapes. The largest and most con- erosion following the dacite erup- of the Campaign Creek block that William Lackey provided helpful suggestions and useful assistance

The rocks of the Apache group tinuous sills, located along the West tion. In places where the dacite lies within the quadrangle. The during the field work; their interest are widespread throughout south- Fork of Pinto Creek, have been was completely removed, Gila congranite is overlain by sedimentary and cooperation are gratefully ern Arizona, and are well repre- intruded into the Martin limestone; glomerate may rest unconformably rocks of the Apache group northsented in the Haunted Canyon quad- other masses have intruded rocks on any of the older formations. west of Campaign Creek, in the

intrusive bodies of quartz monzonite In contrast to the locally derived and the age is provisionally assigned Northward the block narrows and cessive repetition or elimination of

small intrusive basalt bodies crop Basalt of the Apache group is outbursts in the southern part of to 13). Beyond this loop, beds here were established by Ransome upon an erosional surface of mod-sent plugs or small domes occur intrusion of diabase. communication). Correlations and cover the surface and obscure the out abundantly in the Superstition 24, 25, 26).

The thicknesses of sedimentary faults, widespread slumping and single, widespread stage of volcanic attitudes within local areas are must be regarded as approximate creased the difficulty of estabbecause of offsets by the multitude lishing the stratigraphic succession dacite, which apparently covered strata of the Apache group dip of small faults that crisscross the of beds in the Martin limestone, over a thousand square miles steeply northeast or are overarea. Most of these faults have

Escabrosa limestone, and Naco limeoriginally and locally exceeded,

turned to the southwest (section Cture sections A-A', B-B', and D-D' subdivided into six formations of Pennsylvanian and Permian age.

rangle. The Scanlan conglomerate ranging from Pioneer formation to Basalt. - A younger basalt gen-vicinity of Pinto Peak, and southformed on a surface of slight re- Escabrosa limestone. About 1.2 erally crops out between Paleozoic ward near Spencer Spring Creek. DISTRIBUTION AND GENERAL lief, as shown by its remarkable miles south of JK Mountain, diorite limestone and the lower tuff memcontinuity and small variations in porphyry has been intruded along ber of the dacite. Most of the The rocks of this block have under-The Pinal schist of early Pre- thickness. The quartz pebbles most the contact between Troy quartzite basalt is poorly exposed, but a few gone much less intense deformation cambrian age, the oldest rock in likely were mainly derived from and diabase. Abundant bodies crop outcrops clearly show that basalt than the rocks of the Pinto Creek the region, is exposed in scattered stringers and veins in the schist out that are too small to be shown intruded the tuff; the basalt bodies block as shown by the greater are therefore interpreted as forming regularity and continuity of the southeastern parts of the quadsoutheastern parts of the quad shallow plugs and sills. They were formations (section B-B'). Likeage are quartz diorite and Ruin the advancing Apache sea and were Quartz monzonite porphyry.— period of volcanic activity as the diabase was intruded. granite. Ruin granite underlies partly rounded by wave action. Several irregular bodies of quartz basalt flows that are intercalated Strata are moderately tilted in much of the northwestern part of The other fragments and the matrix monzonite porphyry have been with the Gila conglomerate near various directions. Northwest of the quadrangle and occurs in are composed of weathered mate- intruded into Pinal schist, quartz Castle Dome (Peterson and others, Campaign Creek and northeast of scattered outcrops throughout the rial from the underlying rocks and diorite, rocks of the Apache group, 1951, p. 45-46), and the shallow Pinto Peak the beds dip from northremainder of the northern half. apparently were derived from rock and diabase. The diabase and rocks basalt intrusions near the western west to north (section A-A', 2, 4 to Quartz diorite is restricted to small close at hand. The Scanlan con- of the Apache group just north of boundary of the Inspiration quad- 5). The strata surrounding Pinto The Apache group, of late Pre- Creek contains relatively few peb- transected by several dikes of the STRUCTURE show abrupt changes in attitude. The Apache group, of late Precambrian age, overlies the lower bles of white quartz, but contains relatively lew perporphyry that are too small to map.

Ouartz mongonite porphyry underThe Kennedy fault divides the generally southwest. Several north-

Precambrian rocks and crops out abundant angular pebbles and cobextensively throughout the quadextensively throughout two distinct structural blocks. The caused appreciable displacement of one in the northwest quarter of the strata (section A-A', 1, 3, 6). A limestones, rather limited in areal extent, are chiefly in the central,

In the western part of the quadextent, are chiefly in the central,

In the western part of the quadextent, are chiefly in the central,

In the western part of the quadlithelegically resemble both the parts of the quadrangle.

Tangle hear the west rork of rinto dacite and certain of the earlier quadrangle forms the Pinto Creek erably by faults with moderate out extensively throughout most of layer of coarse-grained, pink to is difficult. However, the quartz the quadrangle and is especially grayish red arkose. As the Scanlan monzonite porphyry may have The Pinto Creek block is a graben small displacement are abundant abundant in the central area. A conglomerate is too thin to be intruded the base of the volcanic that has slipped down between the thoroughout the block even in few dikes and sills of diorite por- shown as a separate unit on the rocks locally. A more detailed Kennedy fault on the west and the relatively undisturbed rocks; they phyry crop out in the east-central map, it is included with the Pioneer study will be required to definitely west branch of the Gold Gulch may cause erroneous apparent establish the relations, however, fault on the east (section A-A'). thicknesses of formations by suc-

probably wedges out beyond the strata (section B-B', 16 to 19). quadrangle boundary. A basin near Irregular, relatively thin bodies of TERTIARY(?) ROCKS the northern part of this graben has diabase have intruded both granite tiary age underlie most of the ported from some distance. The Whitetail conglomerate.—White- been filled by Gila conglomerate.A and rocks of the Apache group; southern half of the quadrangle. pebbles show lithologic similarities tail conglomerate was deposited in small horst within this basin has some of them are associated with Small deposits of Whitetail con- to Precambrian quartzites of the low-lying areas on an erosion sur- been elevated, and the exposed faults. A thin, fairly continuous glomerate lie below the volcanic Mazatzal Mountains, 40 to 65 miles face of considerable relief, and it rocks of the Apache group dip sheetlike body, intrusive into granerate, Tertiary and Quaternary, 137, 157-159). The uniformity of mations. Fragments and matrix all A-A', 14 to 15). Southwest of the crops out in a large area in the the Barnes conglomerate in both seem to have been derived locally. basin, in a loop-shaped area cenrangle and in other scattered areas widespread region in southern earlier volcanic rocks were erupted rocks of the Apache group maintain about 150 feet in thickness.

out along Pinto Creek. present only as scattered remnants the quadrangle. In this area they undergo abrupt changes in attitude The Kennedy fault forms the The rock units are briefly because of erosion before the covered parts of the same erosional (section A-A', 11); to the north and boundary between the two major described in table 1. The text that Paleozoic sedimentary rocks were surface upon which the Whitetail west dips are mostly westward structural blocks of the quadrangle follows discusses variations and deposited. In some areas this conglomerate was accumulating. (section A-A', 8 to 11), to the south- (section A-A'). It strikes N. 40° E. certain features of some of the rock erosion also considerably reduced Well-exposed sections in Haunted west dips are southwest, and to the and is clearly defined over a length units. Some units are not men- the thickness of the Mescal lime- Canyon and Pinto Creek show an south and east dips are mostly of some 5½ miles. It is generally upward gradation from Whitetail southward (section D-D'). How- a normal fault dipping steeply conglomerate into the tuff of the ever, any possible systematic folding southeast with rocks of the Apache earlier volcanic rocks. Several that once may have existed here group of the Pinto Creek block The formation names as used The Troy quartzite was deposited rhyolitic bodies that probably reprein his early work in the Globe erate relief, but it appears to be within the unit, but they have not In the north-central area, the a few places it dips steeply northdistrict (1903), the Bisbee district essentially conformable with the been delineated. The earlier vol-sedimentary strata have been cut by west. Its throw is at least 850 feet (1904), and the Ray and Miami underlying formations. Subsequent canic rocks are rather thick in many faults, and many blocks, and probably much greater. areas (1919). He also discussed erosion thinned or, in some places, Wood Creek, Haunted Canyon, and large and small, were engulfed by In the area of Spencer Spring correlations of formations throughout Arizona (1915). He also discussed

correlations of formations throughout Arizona (1915). His dating and
correlations have been modified

and extended in the following

areas (1919). He also discussed the Troy before

the Martin limestone was deposited.

And extended in the following the follow and extended in the following considerable lateral variation, and the south and west have not been obpapers: Darton (1925), Stoyanow no single description will apply to served. Volcanic rocks occupying to be successively set down on the (1926, 1936, 1942), Short and others

all exposures. The section described the same stratigraphic position

to be successively set down on the quadrangle boundary in Spencer northeast and north side of north-spencer north side (1943), Peterson, Gilbert, and Quick
(1951), Huddle and Dobrovolny
(1952), Gilluly, Cooper, and Williams

(1952), Gilluly, Cooper, and Williams

the same strattgraphic position crop out to the south and southwest mear Superior, Picket Post Mountain. Resistant beds of quartzite commonly weather to tain, and in other localities south (1954), and Peterson (written blocky boulders and cobbles that ward toward Ray. They also crop tion A-A', 7, 8, 10,12; section D-D', east the fault either makes a very

fairly consistent. Near the south-

only a few feet of displacement and stone. Therefore, the descriptions stone. Therefore, the descriptions 1,300 feet in thickness, was erupted 1,300 feet in thickness 1,3 onto a surface of considerable re- Haunted Canyon, strata dip mod- dicating postdiabase movement. few tens of feet, and they are so

The Naco limestone was raised to lief. These later volcanic rocks

The volcanic rocks erately east to southeast. Farther closely spaced that they cannot be group status in central Cochise unconformably overlie all the preshown on the map. However, their

County, Ariz., by Gilluly, Cooper,

Tertiary rocks but lie with apparent

Gulch, the dips are mainly eastward.

Spencer Spring Creek area are not

Gulch, the dips are mainly eastward. combined effect is great. Strucand Williams (1954, p. 15-16), and conformity upon both Whitetail

Tertiary rocks but the with apparent of conformity upon both Whitetail

In detail the structural pattern of conformity upon both with a structural pattern of conformity upon both whitetail conglomerate and the earlier vol- the pre-Tertiary rocks is similar to nostic. However, as volcanic rocks show thicknesses that are probably excessive for formations of the hard grade upward into the tuff member likely that this subdivision will be a the hard of the northern part of the block, including complicated fault-Apache group at points such as 9 applicable over a very wide area to 10, 17 to 18, and 27 to 28. In (p. 16). Because only a few remarks the formations seem of the Mose limestone court of the Mose li other places the formations seem
nants of the Naco limestone occur
lain by the thick dacite member.

other places the formations seem
nants of the Naco limestone occur
lain by the thick dacite member.

as north of the headwaters of dacite movement and that the volto be too thin. The apparent in the Haunted Canyon quadrangle,

Above the Whitetail conglomerate,

Haunted Canyon and south and canic rocks were stripped away from the clausted Canyon (received). thicknesses vary widely from
the original usage of the term as a
the contact is arbitrarily placed
the contact is arbitrarily placed
southwest of the Kennedy Ranch, measurements in neighboring areas, formation name is retained here. the contact is arbitrarily placed where pyroclastic material seems the structure is extraordinarily block. to become dominant. Some of the complex, and the map shows only GOLD GULCH FAULT MESOZOIC(?) ROCKS tuff in the earlier volcanic rocks interpretative generalizations. The west branch of the Gold Gulch rocks. Near the end of the period sippian rocks of central Arizona: LOWER PRECAMBRIAN ROCKS

Diabase.—The diabase was emis lithologically similar to the tuff

The Tertiary and Quaternary fault crosses the northeast corner of igneous intrusion in the Globe, The Pinal schist was formed by placed as sills, dikes, and irregular at the base of the later volcanic sedimentary and volcanic rocks of the quadrangle and forms the Miami, and Superior areas, impormetamorphism of shale, arkosic masses and has extensively intruded rocks. Therefore, where dacite have also been faulted, but not east boundary of the Pinto Creek tant amounts of copper and other Peterson, N. P., 1954, Geology of the

some rather complex fault patterns

Peak dip in various directions and

displacement (section B-B', 21). Numerous unmapped faults with ite, consistently crops out 100 to 400 It ranges from a few inches to

KENNEDY FAULT of the Campaign Creek block. In sharp turn to the south or is cut off

usage in this report follow those bedrock. Because of this cover,

Mountains to the west. Whether Most of the southern part of the discussed and applied by Peterson most areas of Troy quartzite are these volcanic rocks once formed a block is underlain by Tertiary volgranite. However, the displacement In addition to abundant small faults, widespread slumping and continuous sheet is not known, but it is likely that they represent a parametrized canic rocks. Where Paleozoic and Precambrian rocks are exposed, an en echelon fault about a mile to The age of the Kennedy fault is uncertain. Evidence for movement

50° southwest. It extends into the apparently lay outside the main GQ-41. where it is one of the important rocks exposed. (Peterson and others, 1951, p. 46-54). diorite porphyry, erosion carved a Survey Bull. 971. determine the amount of slip. In glomerate. Widespread volcanic vey Prof. Paper 21. the Castle Dome area, Peterson activity then occurred, beginning in (1951, p. 52) found that movement the southern part of the quadrangle preceded and followed the intrusion with explosions and outpourings of active after deposition of the Gila earlier volcanic rocks. The volcanic activity was culminated by huge eruptions of gaseous, comminuted

conglomerate. GEOLOGIC HISTORY During early Precambrian time, region. This material remained hot a thick sequence of clastic sedimentary rocks and some volcanic subsequently cooled as a firmly rocks was deposited throughout consolidated dacite. Some faults

central and southern Arizona. In continued to be active after the the Pinal schist during the Mazatzal dacite into the underlying rocks. revolution of Wilson (1939). Be- The fluvial deposits of Gila confore the close of the revolution, glomerate accumulated in broad quartz diorite and Ruin granite in- basins during late Tertiary and truded the Pinal schist. The con- early Quaternary time. During the coarse grain size of the igneous olivine basalt were intruded near the rocks suggest that the deformation eastern quadrangle boundary. The and igneous activity occurred at deposition of the Gila conglomerate considerable depth. Vast amounts was ended by a broad regional upremoved by erosion during subse-streams were reestablished to form quent diastrophism; no record the present drainage system. Much remains of the material removed of the Gila conglomerate and large during this period. Erosion finally amounts of all older rocks have produced a surface of low relief, been removed during the erosion which sank below sea level during which has continued up to the present. Erosion has been vigorous late Precambrian time. The sea was shallow and extended through the latter part of Quateracross much of southern Arizona; nary time as shown by the rugged in it were deposited conglomerate, topography and steep-sided stream

magma which blanketed the entire

small asbestos deposits are fairly

common wherever Mescal limestone

has been intruded by diabase.

Chrysotile bearing beds may reach

several feet in thickness and may

contain from 1 seam to about 6

seams of asbestos. The seams

inches in thickness and average

inch. They are markedly lentic-

and few deposits can be traced for

Several small replacement-type

bodies of iron ore crop out in Mescal

limestone and diabase near the

Kennedy Ranch. Hematite and

sandstone, shale, and limestone of valleys. Recent sedimentary dethe Apache group. Eruptions of posits include talus on hillsides and alluvium in the valleys of interbasaltic lava then spread over a mittent streams. wide area. The region was uplifted, and erosion removed much of the MINERAL DEPOSITS basalt and part of the sedimentary No mineral deposits of economic rocks of the Apache group. In some regions the uplift was ac- value in 1957 are exposed in the companied by slight amounts of quadrangle, and no records exist of tilting, but in the Haunted Canyon any past production. However, quadrangle later faulting and dia- prospectors have found small debase intrusion have obscured any posits of asbestos, iron, and sevrecord of possible deformation eral places where rocks are weakly mineralized with copper. during this uplift. After the land was eroded to a Chrysotile asbestos occurs as thin surface of moderate relief the region subsided, and during Middle The best exposed prospect is 0.8 Cambrian time, the sand and conglomerate of the Troy quartzite mile southwest of the Kennedy Ranch. Most other prospects are were deposited. The region emerged within 2 miles of the ranch, but

and probably remained above sea level during part of the Late Cambrian and all of the Ordovician and Silurian periods. Erosion removed part of the Troy and in places cut down into rocks of the Apache group. No apparent deformation was associated with this period of emergence, but workers in range from a knife edge to 11/2 neighboring areas have dated diabase intrusions as post-Troy and from one-quarter to one-half of an pre-Devonian. Again erosion produced a land surface with mod- ular; individual seams seldom pererate relief, and when the region sist for more than 20 feet laterally, subsided during Late Devonian time conglomerate and sand filled the more than 100 feet. The asbestos depressions. Subsidence continued, is locally of good grade and quality and beds of limestone, sand, and but the small, spotty deposits and shale of the Martin limestone were the expense of transportation have deposited throughout the region. prevented economic exploitation. Deposition of limestone continued in Mississippian and Pennsylvanian times although the absence of strata of Early Mississippian age indicates

magnetite form irregular pods and that deposition was not continuous. tabular bodies along the limestone-However, the Martin, Escabrosa, diabase contact and also extend and Naco limestones seem to be into both limestone and diabase. conformable. It is uncertain how Like the asbestos, the deposits are long deposition continued into the Pennsylvanian and Permian periods spotty and discontinuous; lateral dimensions may reach several tens because only a few thin remnants of Pennsylvanian rocks crop out in No record of sedimentation or volcanism during the Mesozoic era bear any apparent relation to one is known, and it can only be presumed that the region stood as a low, stable landmass. During the great orogenic activity that took places in the southern half of the place in the Cordilleran region dur-quadrangle, in minor shear zones in ing late Mesozoic and early Tertiary time, rocks of the Haunted Canyon quadrangle were tilted and shattered azurite, and other oxidized minerals by an intricate system of faults. forming a thin coating on fracture The great intrusions of diabase walls. Small, disseminated crystals magma were probably associated of pyrite are commonly scattered with this deformation, and these through the surrounding rocks. A few deposits of disseminated pyrite intrusions probably produced many of the complicated structural patterns. Probably some faults were diabase. In Powers Gulch near the active before the diabase was emplaced; these faults together with small veins contain sphalerite and

bedding planes were the channels galena. The veins cut Pinal schist through which the diabasic magma and diabase. Deposits of the was intruded. As increasing various minerals are indicated on amounts of magma were forced in, the map by letter symbols. the engulfed blocks broke along many new fractures which added to the structural complexities in many areas. After the solidification of Darton, N., 1925, A resume of Arithe diabase, activity along many zona geology: Arizona Bur. Mines faults continued. In addition to Bull. 119, 298 p. the diabase, small bodies of diorite Gilbert, G. K., 1875, Report on the porphyry were intruded into the geology of portions of Nevada, Precambrian and Paleozoic rocks in several areas. East and south of the Haunted Canyon quadrangle in this orogeny. Regional correlation would suggest that the quartz monzonite porphyry was intruded during this period, but incomplete evidence also suggests that it may have been emplaced during the

examined in the years 1871 and 1872: U. S. Geog, and Geol, Surthe Globe-Miami district and the veys west of the one hundredth Superior mining area, silicic in-meridian (Wheeler), v. 3, 585 p. trusive rocks were emplaced during Gilluly, James, Cooper, J. R., and Williams, J. S., 1954, Late Paleozoic stratigraphy of central Cochise County, Arizona: U.S. Geol. Survey Prof. Paper 266. Huddle, J. W., and Dobrovolny, Ernest, 1952, Devonian and Missiseruption of the Tertiary volcanic U. S. Geol. Survey Prof. Paper sandstone, and a few strata of the Precambrian resks and possibly overlies earlier volcanic rocks, with the thorough shattering that structural block (section A-A'). It metallic minerals were deposited. Globe quadrangle, Arizona: U.S.

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Utah, California, and Arizona

deposits of the Castle Dome area, Ransome, F. L., 1919, The copper Geol. Soc. America Bull., v. 47, p. Within the Haunted Canyon quad- surface of considerable relief and Ransome, F. L., 1903, Geology of the Paper 115. rangle, Gila conglomerate on the uncovered portions of all the older Globe copper district, Arizona: Short, M. N., and others, 1943, Geol-Soc. America Bull., v. 53, p. 1255southwest is faulted down against formations. Most of the debris was U.S. Geol. Survey Prof. Paper 12. ogy and ore deposits of the Supe-Ruin granite, but because of the transported away from the area, Ransome, F. L., 1904, Geology and rior mining area, Arizona: Ari- Wilson, E. D., 1939, Pre-Cambrian glomerate, it is not possible to areas to form the Whitetail con- rangle, Arizona: U. S. Geol. Sur- Stoyanow, A. A., 1926, Notes on re- Arizona: Geol. Soc. America Bull., cent stratigraphic work in Ari- v. 50, p. 1113-1164.

ozoic sections in Arizona and 12, p. 311-324.

paleogeography of Arizona: Geol.

zona: U. S. Geol. Survey Prof. Stoyanow, A. A., 1942, Paleozoic TABLE 1. DESCRIPTION OF ROCK UNITS IN THE HAUNTED CANYON QUADRANGLE

may be from almost any of the rock formations. Talus is generally mapped only where it obscures important geologic relations; talus slopes are common throughout the quadrangle Sand and gravel deposits along valley and canyon floors Dense, aphanitic groundmass containing iddingsite grains and variable amounts of altered plagioclase laths; tiny needles to euhedral phenocrysts 2 mm in length. Plagioclase largely altered to clay and calcite. scattered pyroxene grains; groundmass dark gray; scattered vesicles. Outcrops inconspicuous, weathered Angular to subrounded fragments ranging in size from pebbles to boulders in coarse-grained poorly sorted sand of quartz, feldspar, and rock fragments. Most common fragments are dacite and rhyolite; also common are diabase, quartzite, limestone, granite, and schist. Matrix of sand largly derived from dacite, commonly cemented by silica or carbonate. Bedding indistinct in most places, locally well defined. Gen-Dacite About 40 percent phenocrysts, 1-2 mm in diameter, mostly of plagioclase (andesine, An 35-40), acapatite. Groundmass is cryptocrystalline silica and feldspar with finely interspersed brownish dust. Tex Variable: | imately | brown, weathers to pinkish brown; flattened lapilli and bombs of pumice, and xenoliths of rhyolite, diabase, and quartzite; forms pinnacles, cliffs, and steep slopes 'itrophyre. Phenocrysts same as dacite. Groundmass ranges from entirely glassy to mostly cryptcrystal line with scattered, flattened glass streaks; pyroclastic shard structures common in the glass. Glass is black; cryptocrystalline material is brown to gray; ledge forming 10-100 Cutrops yellowish gray, moderate red. Generally without bedding but locally well-bedded and contains admixed clastic material; grades upward into vitrophyre. Slope forming Heterogeneous formation, with many lateral and vertical changes in rock type; some changes abrupt, others Rhyolite Light- to medium-gray aphanitic groundmass with scattered phenocrysts of quartz, plagioclase, sanidine, biotite, and magnetite. Flow banding distinct to indistinct, locally highly contorted. Locally partly altered to clay minerals, calcite, and chlorite to form a grayish-yellow felsite

Perlite. Black glass groundmass with well-defined perlitic cracks; locally color varies to brown, gray, red, or green. Scattered phenocrysts of quartz, plagioclase, sanidine, biotite, magnetite, and zircon. Flow banding generally distinct. Glass has undergone variable amounts of devitrification ranging from thin films of microlites along perlitic cracks to completely devitrified grayish-yellow felsite with relict perlitic Variable, 0-1300 Lithophysae and other spheroidal structures are common along surfaces between rhyolite and perlite Tuff. Typically a fine-grained to aphanitic, vitroclastic mixture of devitrifed shards, lithic ash, scattered phenocrysts, pumice lapilli, and small xenoliths. Composition, structure, and texture widely variable; tuff from well consolidated to friable, and from well bedded to unbedded. Generally grayish yellow light gray, light brown, white Breecia. (a) Pumice bombs and angular lithic fragments in a coarse-grained, poorly sorted clastic matrix.

Commonly interbedded with tuff. (b) Angular fragments of felsite and rhyolite in a groundmass of jumdesite and trachyte Medium-gray, dark-gray, to dark-brown aphanitic rock, with felted mass of tiny plagioclase laths in a cloudy cryptocrystalline aggregate, with scattered phenocrysts of plagioclase and Angular to subangular pebbles, cobbles, and boulders from all older formations; diabase, quartzite, and limestone most common; range from a fraction of an inch to more than a foot, but average from 1 inch to 5 inches. Matrix is coarse-grained, poorly sorted sand, largely derived from diabase. Outcrops brown to ly indurated to friable; fragments range from closely packed to sparsely scattered; in places confined forming, a few resistant beds form ledges. Grades upward into tuff; top of formation is indefinite Phenocrysts of euhedral plagioclase and perthitic potassium-feldspar and anhedral quartz in a very fine

Phenocrysts average 3 to 5 mm and reach 1 cm. Groundmass grains average about 0.1 mm, and grade rystalline size at chilled borders. Quartz phenocrysts deeply embayed; some show r crystallized borders. Alteration has permeated the entire mass, with albitization of the plagioclase, monly lined with epidote crystals. A few cavities are filled with a single crystal of euhedral quartz which may reach an inch in length. Groundmass locally shows granoblastic textures. Fresh and weathered surfaces light brown to pale yellowish brown. Forms cliffs and steep slopes uhedral plagioclase and hornblende phenocrysts in a medium-gray to dark-gray aphanitic groundmass. Plagioclase tabular, averages about 1 mm in diameter; largely altered to clay and calcite. Hornblende forming, generally deeply weathered; outcrops medium gray to yellowish gray

magnetite and apatite. Augite and labradorite may poikilitically include the other minerals. In pegmamonly is medium-grained with grains averaging ½ to 2 mm in diameter. Locally porphyritic, with plagioclase phenocrysts up to 5 cm in length in an aphanitic groundmass. Dark-gray to nearly black; weathers to dark shades of brown, green, gray. Slope forming; generally deeply weathered Limestone, fine- to medium-grained crystalline light-gray, locally weathers to very pale blue. Beds are dis-Erosional remnants | beds are humpy; probably a result of irregular concentration of silica. Limestone beds more than 30 feet eous shale sporadically interbedded throughout formation. Near base the shale is red, but higher is light gray to pale yellowish brown; commonly contains fragmental chert Limestone, mostly fine-grained, but some coarse-grained crystalline, light- to medium-gray; well-defined thin to medium beds. Crinoid fragments common, also contains scattered horn corals, brachiopods, and gastropods. Some limestone contains nodular chert; locally limestone contains finely dispersed silica. Slope

Limestone, mostly coarse-grained, but varies to fine-grained crystalline, light- to medium-gray; most bedding indistinct and discontinuous; beds, where defined, are generally thicker than 8 feet. Locally the and medium beds interbedded with massive layers. Some beds colitic, others composed of abundant fossil fragments; scattered chert nodules; cliff forming Shale, thin-bedded, fissile, calcareous, greenish gray, weathers pale yellowish brown. (Commonly covered by imestone, coarse- to fine-crystalline. Some nearly pure, but most is admixed with clay, silt, or sand. Pale

medium gray to pale yellow to moderate grayish red. Distinctly bedded; individual beds range from 1 100-300 to 4 feet in thickness. Some contain medium to coarse, well-rounded, frosted quartz grains. Several beds of silty limestone are crowded with brachiopods and other fossils. Interbedded with limestone are two or three layers of hard, fine- to medium-grained quartzite, containing coarse, rounded, frosted quartz grains. Light-brown to grayish-yellow. Quartzite layers range from 2 to 15 feet in thickness. Conglomerate of angular pebbles of quartzite, schist, granite, limestone in coarse-grained matrix Quartzite, fine- to very fine-grained, mostly quartz grains but locally arkose; gritty lenses common, with

of feet. Although both asbestos and thin layers of fissile shale. Outcrops light-brown to grayish-yellow. Distinct beds 6 inches to 4 feet thick; iron are associated with the Mescal Siltstone, mudstone, arkose, and quartzite, interlayered mostly dusky-red to brownish-red, distinctly but irlimestone and diabase, they do not Angular to rounded pebbles of quartzite, schist, granite, and limestone in coarse-grained, poorly sorted Troy mostly slope forming, quartzite locally forms ledges Weakly mineralized copperbearing rocks occur in several Originally aphanitic to fine-grained olivine basalt, but now consists of a felted mass of plagioclase laths reach about 120 medium-gray, grayish-green and reddish-brown. Scattered round vesicles, as large as half an inch. Some Most deposits consist of malachite, Mainly a fine-grained, dense aggregate of calcite and chalcedony that grades into pure crystalline limesto

> 250 approximately wavy. White, gray, brown, and black chert is common as nodules, layers, and irregular masses. Local stone may be serpentinized near diabase intrusions, locally chrysotile asbestos has formed. Generally Ourtzite fine-grained interhedded with thin layers of mudstone and shale. Fresh rock is white, light-200-300 brown, light-gray; weathers to dark-brown, red, and yellow. Bedding distinct, from a quarter of an inch to 12 inches thick and locally ripple marked. In places the upper 10 to 20 feet contain abundant fine sand grains in a dense limey to cherty matrix; lime increases upward; generally forms slopes White, medium-grained, nearly pure quartzite; forms ledge Quartzite, medium- to coarse-grained, poorly sorted, feldspathic, grayish-yellow, light-gray, white; weath-100-200 ers to light-brown; locally grayish red-purple with bleached spots. Crudely defined beds 3 to 12 feet thick; crossbedding common; forms blocky ledges

Well-rounded, ellipsoidal pebbles (average 2 to 4 inches long), cobbles, and a few houlders (as much as 12 inches long) of pale-brown to light-gray quartzite, white quartz, chert, and red jasper in medium-to coarseaverage 10-20 grained matrix of light-brown to grayish-yellow arkosic quartzite; firmly indurated by silica cement. bles tend to be concentrated in lenticular beds separated by matrix with sparsely scattered pebbles Crudely stratified; matrix locally crossbedded. Commonly forms blocky ledges with nearly vertical faces 25-60 Quartzite, poorly sorted, coarse-grained, arkosic; grains of well-rounded to subangular quartz and feldspar approx - 25-100 Alternating layers of thin-bedded fissile shale and medium-bedded, very fine grained feldspathic quartite

brown spots. Locally entire beds may assume pale yellowish brown color; lateral variations from one olor to the other are common. Siltstone beds form slopes; quartzite beds tend to form ledges of white quartz and fragments of schist and granite in a coarse-grained, poorly sorted matrix of arkose. from sparsely scattered to closely packed; bedding indistinct or absent; forms ledges Quartz monzonite, coarse-grained, porphyritic; euhedral phenocrysts 2-8 cm of perthitic pink microcline in a coarse-grained hypidiomorphic-granular groundmass of sodic plagioclase, microcline, quartz, and biotite, with accessory sphene, magnetite, apatite, and zircon. Locally grades to fine-grained, non-porphyritic and of pegmatite. Outcrops light brown, light gray, grayish yellow. Generally forms slopes, locally forms Medium- to fine-grained, holocrystalline, with hypidiomorphic-granular texture. Essential minerals are

nagnetite and apatite, and locally small garnet grains. Slight to moderate development of gneissose ructure; locally quartz shows granoblastic texture. Outcrops light brown to grayish yellow. Forms Quartz-muscovite schist distinctly foliated, fine- to coarse-grained; contains various amounts of chlorite varies from light to dark gray, locally pale blue; generally highly contorted, and commonly transected by Hornfels, very fine-grained, with quartz, feldspar, mica, and chlorite; light-gray to dark-gray; locally shows

SECTION ALONG LINE D-D'

White to medium-gray, locally pale-blue to pale-green; generally weathers white to light-gray, locally Base map by Topographic Division U. S. Geological Survey, 1948

DEPARTMENT OF THE INTERIOR

UNITED STATES GEOLOGICAL SURVEY

GEOLOGIC MAP HAUNTED CANYON QUADRANGLE, ARIZONA Donald W. Peterson

SECTION.ALONG LINE A-A'

Scale 1:24 000

Contour interval 40 feet Datum is mean sea level

אמתחמים יודק משפח This report is proliminary and has

not been edited or reviewed for

conformity with Geological Survey

standards or nomenclature.

HAUNTED CANYON QUADRANGLE

Whitetail conglomerate

Quartz monzonite porphyi

Diorite porphyr

Mescal limestone

Dripping Spring quartzite and

Ruin granite

Quartz diorite

Contact, showing dip

Fault, showing dip

Dashed where approximately

located

Vertical fault

Concealed fault

Strike and dip of beds

Strike and dip of over-

turned beds

Strike of vertical

Horizontal beds

Strike and dip of foliation

Strike and dip of planar

structures in volcanic rocks

Portal of adit

Copper prospect

Asbestos prospect

Pyritized area

Text reference points

shown on cross sections

INTERIOR-GEOLOGICAL SURVEY, WASHINGTON, D. C. MR 1572

Geology mapped by D. W. Peterson

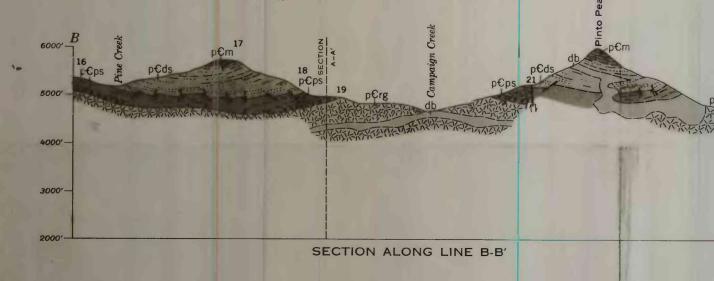
and N. P. Peterson, 1953 - 57

halerite-galena vein

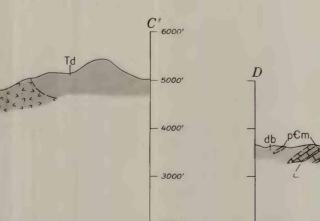
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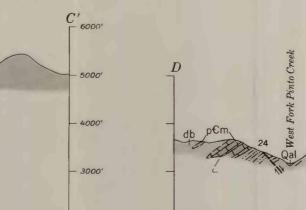
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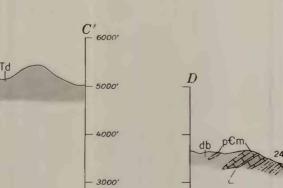
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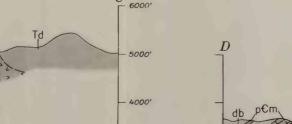


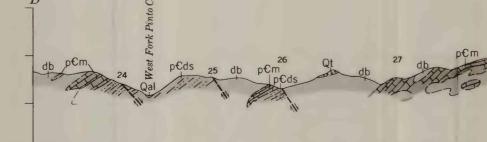
SECTION ALONG LINE C-C'











Felsite, light-gray, aphanitic, without foliation